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LIFE HISTORY STUDIES, HOST RECORDS, AND MORPHOLOGICAL DESCRIPTION OF GENITALIA OF *EURYTOMA TYLODERMATIS* ASHM. (HYMENOPTERA: EURYTOMIDAE) FROM SOUTH DAKOTA

B. McDaniel and A. Boe

Plant Science Department, South Dakota State University, Brookings, South Dakota 57007.

Abstract.—*Eurytoma tylodermatis* Ashm. was found to be parasitic on *Acanthoscelides perforatus* (Horn) in seed pods of Canada milk-vetch (*Astragalus canadensis* L.). Observations on larval behavior and frequency of parasitism are discussed. Male and female genitalia of *E. tylodermatis* are illustrated.

Key Words: *Acanthoscelides perforatus, Dinarmus acutus, Astragalus canadensis*

Eurytoma tylodermatis Ashm. parasitizes bruchid beetles and numerous other Coleoptera throughout the eastern and central United States (Burks 1979). Bugbee (1967) listed 56 host species for *E. tylodermatis,* many of which are of economic importance, but cautioned that more exact determinations of host relationships are needed. He stated that the species can act as either a primary or secondary parasite on beetles and moths. Pierce (1908) regarded it as an important parasite of the cotton boll weevil (*Anthonomus grandis* Boheman) in Texas, and Ritcher (1936) recorded its parasitism of the larger apple curculio (*Tachypterellus quadrigibbus magnus* List) in Wisconsin.

This paper records a new host for *E. tylodermatis,* presents descriptions of *E. tylodermatis* male and female genitalia, and describes observations and data regarding larvae and adults of *E. tylodermatis* associated with Canada milk-vetch in eastern South Dakota.

Materials and Methods

In August 1988 and 1989 mature seed pods (Fig. 1) of Canada milk-vetch were collected from a field nursery at Brookings, South Dakota and placed in 0.9-liter glass jars (five to ten racemes per jar in ten jars) in 1988 and 1.8-liter paper cartons (ten to twenty racemes per carton in five cartons) in 1989. Jars were sealed and maintained at room temperature. Cartons were wrapped with aluminum foil and fitted with a 5-ml vial to serve as a trap (Fig. 2). Cartons were placed on a shaded bench in a greenhouse. Chalcids that emerged from pods in the jars during fall of 1988 and bruchids that emerged during spring of 1989 were removed, identified, and counted in July 1989. Cartons were checked daily through October 1989 and chalcids trapped in the vials were identified and counted.

In June 1989, green pods containing developing seeds were dissected in order to make observations on chalcids parasitizing *A. perforatus* larvae. Chalcid larvae found parasitizing beetle larvae were placed in 5-ml vials and observed daily until adults emerged.

Genitalia were removed from ten females and ten males of *E. tylodermatis.* Illustrations were made for both sexes and data

Fig. 1. Pods of Canada milk-vetch (*Astragalus canadensis* L.).

were recorded for number of rami spines and eighth tergite setae of the females. Morphological terminology is that of Snodgrass (1941).

Results and Discussion

The following is a description of female and male reproductive structures based on the 20 adults obtained from laboratory rearings.

Female (Fig. 3): 2nd Valvifers (Vf2) (semicircular sheaths) with two setae near apodemes of laminated bridge (Lam.Br.); ramus spines (Ra.Sp.) range from 23 to 35 on right valvifer (mean of 29.6 for 10 specimens), and from 25 to 36 on left valvifer

Fig. 2. Paper carton rearing container.

(mean of 30.5 for 10 specimens); spines widely spaced in laminated bridge region, close together near fulcral plate region; fulcral plate (Ful.Pl.) attachment near notched area (Ful.Pl.Not.) of fulcral plate; outer ovipositor plate (Ops.Ot.Pl.) fused with 8th tergite (8-Teg.); 8th tergite with row of setae (8-Teg.Set.) ranging from 41 to 51 (mean of 46.3 for 10 specimens), setae count begins with first seta anterior to cercus (Ce.); setae single adjacent to cercus becoming paired toward attachment of outer ovipositor plate and fulcral plate; setal region plated, bordered by dark line that divides fused outer ovipositor plate into light and dark pigmented areas; apex of 8th tergite with series of long setae similar in structure to other 8th tergite setae [these setae associated with epipygium (Ep.)]; cercus with 5 setae of different sizes and shapes. Inner ovipositor plate (Ops.In.Pl.) separated from 2nd valvifers (Vf2) by darkened region that connects apodemes of outer and inner rami and the groove in which the fulcral plate fits along with monitoring spines (Ful.Pl.Sp.); inner ovipositor plate with plated region extending to region of fused ovipositor sheaths (Ops.Sh.); ovipositor sheath not articulated, containing the ovipositor sheath ligament (Ops.Sh.Lg.) which connects sheaths in which the ovipositor is held; ovipositor sheaths lightly striated with typical series of eurytomid setae at apex.

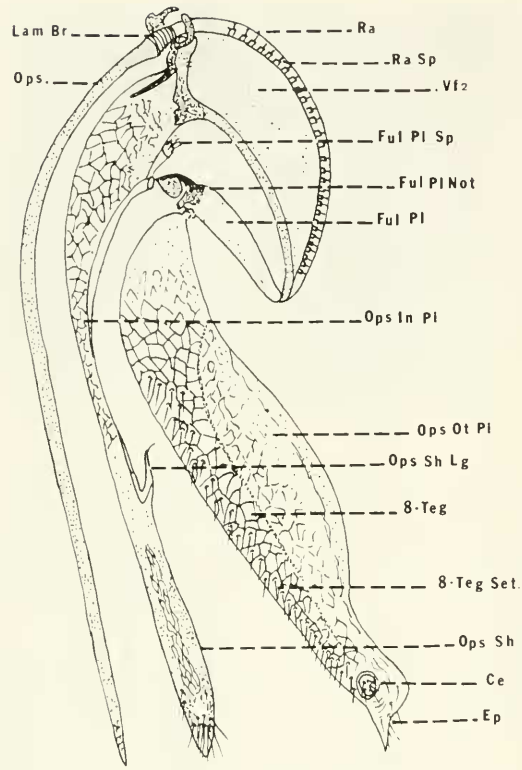
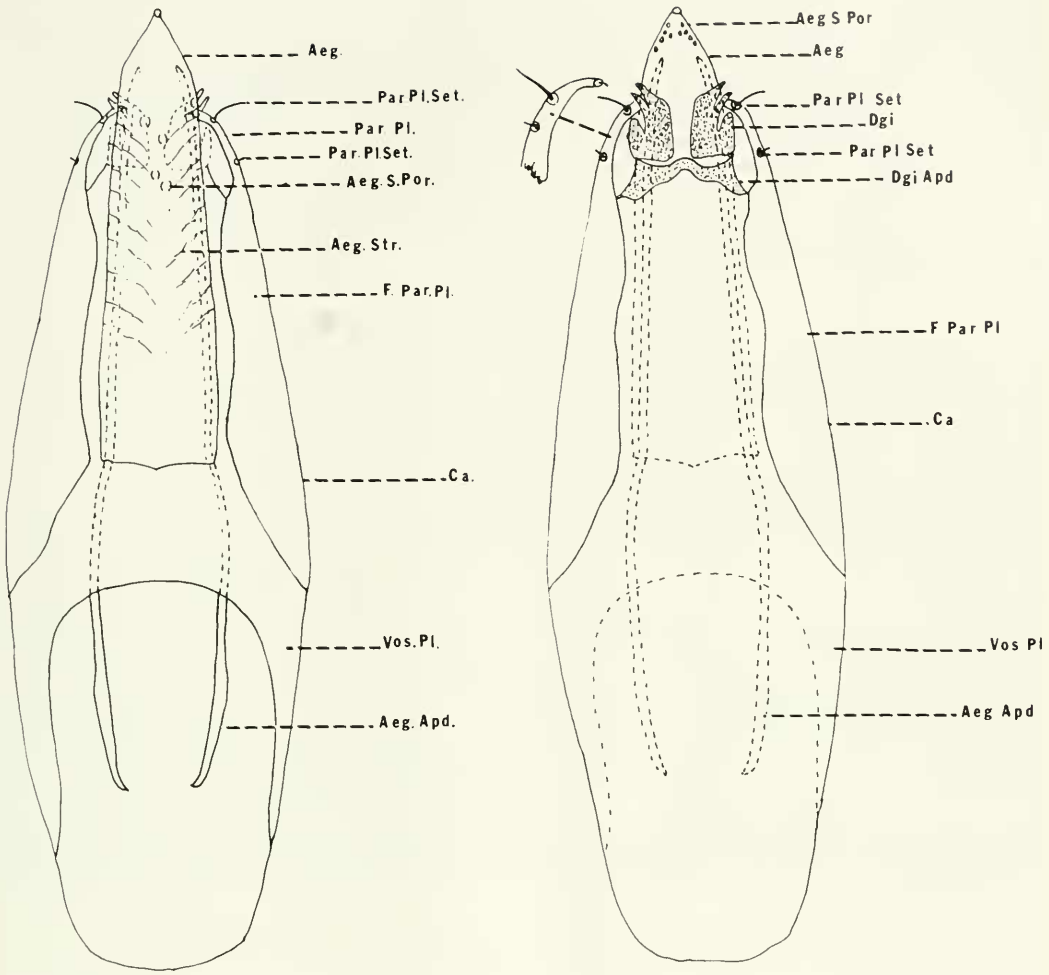


Fig. 3. Ovipositor of *Eurytoma tylodermatis* Ashm. Abbreviations: (Lam.Br.) Laminated bridge; (Ra.) Ramus; (Ra.Sp.) Ramus spines; (Vf2) 2nd Valvifer (Semicircular sheet); (Ful.Pl.Sp.) Fulcral plate spines; (Ful.Pl.Not.) Fulcral plate notch; (Ful.Pl.) Fulcral plate; (Ops.In.Pl.) Ovipositor inner plate; (Ops.Ot.Pl.) Ovipositor outer plate; (Ops.Sh.Lg.) Ovipositor sheath ligament; (8-Teg.) 8th tergite; (8-Teg.Set.) 8th tergite setae; (Ops.Sh.) Ovipositor sheath; (Ce.) Cercus; (Ep.) Epipygium.

Male (Figs. 4, 5): reproductive apparatus with 4 dorsal aedeagal sensory pores (Aeg.S.Por.); aedeagal striae (Aeg.Str.) extend from posterior aedeagal sensory pores to beyond anterior aedeagal sensory pores; aedeagal sensory pores may be paired or staggered on dorsal surface of aedeagus (Fig. 4); ventrally apex of aedeagus with five sensory pores on each side; these smaller than dorsal pores; aedeagus (Aed.) elongated capable of extending beyond digiti (Dgi.); parameres with three setae; apex setae normally hidden between digiti and aedeagus; paramere plate setae (Par.Pl.Set.) located on outer margin of curved paramere plate (Par.Pl.); posterior paramere plate setae longer and larger than anterior paramere plate setae; anterior paramere plate setae located adjacent to digiti apodemes (Dig.Apd.); apex setae similar in size to latter paramere setae; digiti with two finger-like teeth and a rounded projection; each digitus with two pores on base; digital apodemes short (Fig. 5), fused to aedeagal apodemes (Aeg.Apd.); aedeagal apodemes protrude from caulis (Ca.); paramere plates (Par.Pl.) and Volsellar plates (Vos.Pl.) fused to caulis with pigmentation being darker on the sides of reproductive apparatus and lighter in the center; caulis forms opening below digiti in which aedeagal apodemes are connected to muscles of the 8th tergite. There is a narrow nonpigmented membrane connecting the aedeagus to the epipygium and 8th tergite. This membrane is beset with small spine-like setae. The membranous portion of this structure surrounds the aedeagus and contains two acorn-like setae. This structure is attached to the aedeagus and apparently plays a role in exsertion and retrieval of the entire male reproductive apparatus as well as the aedeagus.

Parasitic Behavior

Information on behavior of *E. tylodermatis* larvae was obtained by splitting green, well-developed seed pods along their septa to expose seeds in the chambers of each of the two locules. On July 18, 1988, we observed a pinkish-white larva that was feeding on an *A. perforatus* larva. A grayish-black, pubescent hatched egg, which resembled *E. tylodermatis* eggs (Pierce 1908), was attached to the bruchid larva. The pod locule containing the parasitic larva and its host was placed in a 5-ml vial and stored at room temperature. Daily observations were made and on July 22 the parasitic larva crawled out of the locule, defecated, and pupated. By July 26 the pupa had become solid black except for prominent reddish-



Figs. 4, 5. Male reproductive apparatus of *Eurytoma tylodermatis* Ashm., dorsal and ventral, respectively. Abbreviations: (Aeg.) Aedeagus; (Par.Pl.Set.) Paramere plate setae; (Par.Pl.) Paramere plate; (Aeg.S.Por.) Aedeagal sensory pores; (Aeg.Str.) Aedeagal striae; (F.Par.Pl.) Fused paramere plate; (Ca.) Caulis; (Vos.Pl.) Volsellar plate; (Aeg.Apd.) Aedeagal apodemes; (Dgi.) Digiti; (Dgi.Apd.) Digiti apodemes.

brown compound eyes. On July 30 an adult female of *E. tylodermatis* emerged and was one of the ten females studied for the structure of the genitalia. These observations made it possible to recognize *E. tylodermatis* larvae in subsequent pod dissections.

Numbers of adult *E. tylodermatis* and the pteromalid *Dinarmus acutus* Thomson reared from inflorescences of Canada milkvetch in 1988 and 1989 are presented in Table 1. Total numbers recorded of each species were 68 and 112 for *E. tylodermatis* and *D. acutus,* respectively. Male *D. acutus* outnumbered females by 67% while females of *E. tylodermatis* outnumbered males by 52%. The number of *A. perforatus* adults reared in 1988 was 70, indicating that approximately 35 and 24% of the beetles were parasitized by *D. acutus* and *E. tylodermatis,* respectively. Since *D. acutus* outnumbered *E. tylodermatis* by approximately 50% in 1989 rearings, the pteromalid was the more predominant parasite of *A. perforatus* in this study. These data agree closely with a previous study on the effects of parasitism by *D. acutus* on Canada milk-

Table 1. Numbers of parasitic chalcids reared from Canada milk-vetch pods infested with the bruchid *Acanthoscelides perforatus*.

Year	*Dinarmus acutus*		*Eurytoma tylodermatis*	
	Male	Female	Male	Female
	no.			
1988	39	21	18	22
1989	31	21	9	19

vetch seed predation by *Acanthoscelides perforatus* (Horn) (Boe et al. 1989). In that study, *D. acutus* parasitized over 45% of *A. perforatus* larvae.

We have reared *E. tylodermatis* from seed pods of American licorice (*Glycyrrhiza lepidota* Pursh) and false indigo (*Amorpha fruticosa* L.) containing *Acanthoscelides aureolus* (Horn) and *A. submuticus* (Sharp), respectively. It is likely that *E. tylodermatis* also parasitizes bruchid beetles in seeds of these two legumes. However, we have not dissected pods to observe *E. tylodermatis* larvae feeding behavior in these species.

Acknowledgments

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